REMARKS

Favorable consideration and allowance of the present application is respectfully requested.

Claims 82-122, including independent claims 82, 99, and 113, are currently pending in the present application. Independent claim 82, for instance, is directed to a method for forming a paper web that contains a first layer formed primarily from hardwood fibers. The method comprises treating the hardwood fibers with a first hydrolytic enzyme to hydrolyze and form aldehyde groups predominantly on the surface thereof, wherein the dosage of the hydrolytic enzyme is from about 0.1 to about 10 s.e.u. per gram of oven-dried pulp. The first hydrolytic enzyme comprises a cellulosic-binding domain free endo-glucanase. In addition, the method also comprises treating the hardwood fibers with a cross-linking agent that forms a bond with the aldehyde groups on the surface of the hardwood fibers.

In the Office Action, independent claims 82, 99, and 113 were again rejected under 35 U.S.C. §103(a) as being obvious over WO 98/56981 to Seger, et al. Seger, et al. is directed to modified cellulosic fibers having a reduced dry zero span tensile index. To obtain the modified cellulosic fibers, a cellulase-containing enzyme is added to an aqueous slurry of fibers. (pg. 13). The enzyme modifies the morphology of the fibers. (pg. 13). After mixing of the fibers and enzyme preparation, the mixture is preferably, though not necessarily, combined with a debonder or chemical softener to preserve the fiber morphology that results from enzymatic action. (pg. 13). Specifically, Seger, et al. indicates that the addition of a debonder to wet enzyme-modified fibers prevents the "repair" of the fibers that would otherwise take place upon drying. (pg. 17).

As indicated in Applicants' previous response, it is believed that the enzymes of Seger, et al. (e.g., Cellucast®, Celluzyme®, Pergolase®, and Carezyme®) have a cellulosing-binding domain that attaches to the fiber surface and hydrolyzes the cell wall. This weakens the fibers, thereby making them more flexible and providing a reduced zero span tensile strength.

The recent Office Action raises several points with respect to this issue. First, it was stated that the enzymes of Seger, et al. function in the same manner as the enzymes set forth in independent claims 82, 99, and 113 "since it produces the same effect, i.e., increased tensile strength." However, Applicants note that, according to Seger, et al., there is at least about a 35% reduction in the "dry zero span tensile index" after being treated with an enzyme. (See e.g., pg. 3). Specifically, tensile strength is said to be controlled by two primary factors, i.e., "fiber zero span tensile strength" and "fiber-fiber bonding." With tissue and towel products, the "fiber zero span tensile strengths" are generally at least 10 times greater than the overall tensile strength of the sheet, which indicates that "fiber zero span tensile strength" can be reduced without adversely affecting overall product strength. (pg. 2). Thus, the purpose of Seger, et al. is to reduce "zero span tensile strength" without reducing fiber-fiber bonding as a technique for providing a product with enhanced softness without negatively impacting strength to a significant degree. (pg. 3).

This is in direct contradiction to independent claims 82, 99, and 113. In the present claims, the combination of a cellulosic-binding domain free endo-glucanase with a crosslinking agent acts to increase overall tensile strength. Specifically, the enzyme hydrolyzes the fiber predominantly at or near the surface, thereby avoiding or

minimizing the degradation of cell walls found with other types of enzymes. (Appl. pg. 8). Moreover, a crosslinking agent may form a bond with groups formed predominantly on the surface of the enzyme-treated fibers and act as a "bridge" between the groups and two or more enzyme-treated fibers. (Appl. pg. 12-13). Thus, contrary to the strength reduction and fiber degradation achieved by Seger, et al., independent claims 82, 99, and 113 cause in an increase in tensile strength.

In the Office Action, it was also stated that it would have been obvious to employ the claimed enzyme because it is a commercially available form of endo-glucanase. However, Applicants note that Seger, et al. teaches away from employing enzymes that do not substantially "damage" fiber morphology. Seger, et al. requires fiber degradation to achieve the reduction in zero span tensile strength desired. For instance, Seger, et al. indicates that the enzyme modifies the morphology of the fibers. (pg. 13). Further, Seger, et al. also states the following:

> While not wishing to be bound by theory, it is believed that the debonding agent maintains the fiber "damage" caused by the enzymatic attack on the fiber. That is, after the enzyme alters the morphology of the fiber, the debonding agent prevents the "repair" of the fiber, at least to some degree, that otherwise may take place upon drying.

(pp. 16-17) (emphasis added). From the above, it is clear that the enzymes of Seger, et al. must damage the fibers to achieve the desired results.

Again, to the contrary, independent claims 82, 99, and 113 utilize an enzyme that specifically minimizes fiber degradation, and instead attacks predominantly the surface of the fiber. Consequently, crosslinking agents may act as a "bridge" between these modified fibers to increase the overall tensile strength of the product. Seger, et al.

simply teaches away from independent claims 82, 99, and 113. In fact, the only rationale for modifying Seger, et al. in the suggested manner appears to be based on (1) the notion that it would have been "obvious to try" the claimed enzymes, and/or (2) the teachings of Applicants' specification, both of which are improper under 35 U.S.C. §103(a). Thus, for at least these reasons, Applicants respectfully submits that independent claims 82, 99, and 113 patentably define over Seger, et al.

In addition, Seger, et al. also fails to recognize the synergistic combination of web construction, enzyme treatment, and cross-linking achieved according to independent claims 82, 99, and 113. Independent claim 82, for instance, requires that the paper web contain a layer formed primarily from hardwood fibers. By containing hardwood fibers, the layer is relatively soft in comparison to layers formed with certain other types of fibers. However, soft fibers also tend to result in a layer that is weaker and has higher levels of lint and slough.

To counteract this tendency, Applicants have discovered that a combination of a specific dosage of a hydrolytic enzyme and a cross-linking agent in the hardwood fiber layer can reduce lint and slough without substantially sacrificing softness. Specifically, the hydrolytic enzyme hydrolyzes the hardwood fibers and forms aldehyde groups predominantly on the surface thereof. These aldehyde groups become sites for cross-linking. Thus, the cross-linking agent forms a "bridge" between the aldehyde groups of two or more enzyme-treated fibers. For example, one hydroxy moiety of starch can form a glycosidic bond with an aldehyde moiety of one enzyme-treated fiber, while another hydroxy moiety of starch can form a glycosidic bond with an aldehyde moiety of another enzyme-treated fiber. (Appl. pg. 14). In addition, by randomly cutting or

hydrolyzing the fiber cellulose predominantly at or near the surface of the fiber, degradation of the interior of the fiber cell wall is avoided or minimized. Consequently, the resulting paper web exhibits reduced levels of lint and slough.

Seger, et al. does mention that starch binders may be included in the papermaking fibers to reduce linting. (pgs. 21-22). However, Seger, et al. fails to recognize the ability of a cross-linking agent to form a "bridge" between enzyme-treated fibers as described above. Furthermore, Seger, et al. also fails to recognize the combination of each of these aspects with the specific web construction that includes a layer of primarily hardwood fibers treated with both an enzyme and a cross-linking agent, which provides a synergistic paper web that is soft, strong, and has low levels of lint and slough. Thus, when viewing the teachings of Seger, et al. in their entirety, one of ordinary skill in the art would simply not have found it obvious to achieve the aspects of claims 82, 99, and 113.

In addition, the above-cited reference was also cited to reject dependent claims 83-98, 100-112, and 114-122. Applicants respectfully submit, however, that at least for the reasons indicated above relating to corresponding independent claims 82, 99, and 113, claims 83-98, 100-112, and 114-122 patentably define over the reference cited. However, Applicants also note that the patentability of dependent claims 83-98, 100-112, and 114-122 does not necessarily hinge on the patentability of independent claims 82, 99, and 113. In particular, it is believed that some or all of these claims may possess features that are independently patentable, regardless of the patentably of claims 82, 99, and 113.

In summary, it is respectfully submitted that the claims are patentably distinct over the prior art of record. Thus, it is submitted that the present application is in complete condition for allowance and favorable action, therefore, is respectfully requested. Examiner Chin is invited and encouraged to telephone the undersigned at his convenience should any issues remain after consideration of the present response.

Please charge any additional fees required by this Response to Deposit Account No. 04-1403.

Respectfully submitted,

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